

REMARKS

In view of the advanced stage of prosecution, Applicants' undersigned representative requests the benefit of a personal interview with the Examiner should any substantive issues remain. Such an interview prior to the issuance of a further action will serve expedition and economy in the handling of this case.

In the meantime, however, the rejections of Claims 1, 4-6, 10, 11 and 17 as being anticipated by newly cited Strehlau under 35 U.S.C. §102(b), of Claims 2, 3, 9 and 18 (Claims 13-16 no longer being in issue) as being unpatentable over Strehlau under 35 U.S.C. §103(a), of Claims 7 and 8 as being unpatentable over Strehlau et al in view of McCabe under 35 U.S.C. §103(a), of Claim 12 as being unpatentable over Strehlau in view of Twigg under 35 U.S.C. §103(a), and of Claims 19 and 20 as being unpatentable over Strehlau in view of Taga and Kubo et al under 35 U.S.C. §103(a), are each respectfully traversed. Reconsideration is requested in view of the foregoing amendments and following remarks.

The newly cited Strehlau patent is common to all of the above traversed rejections. It discloses that a sulfur trap contains alkaline earth metal, and the sulfur trap is regenerated by subjecting it to high temperature $T_{k,DeSO_x}$. Specifically, the Strehlau patent discloses, as the Examiner notes, "a catalyst (8, Fig. 21) for oxidizing the sulfur components, disposed before the sulfur component trapping agent...wherein the sulfur component trapping agent does not substantially release the trapped sulfur components under the conditions of the internal combustion engine (col. 7, lines 24-45)".

The Strehlau patent does not disclose, however, that the sulfur component trapping agent does not release the trapped components under the operating conditions of the internal combustion engine. At col. 7, lines 56-61, the Strehlau patent states that: after a predetermined number of N₂ of nitrogen oxides storage cycles, process step (b) is initiated to remove the sulfur from the sulfur trap. For this step, the engine exhaust gas temperature is raised to the value TM₂ and the normalized air/fuel ratio of the exhaust gas is lowered to a value between 0.6 and 0.9. To do this, the fuel is consumed. In other words, the Strehlau process is concerned with regenerating the sulfur trap under the operating conditions, not replacing the sulfur component trapping agent with a new one when degradation is indicated. Thus, Strehlau cannot be said to provide a *prima facie* case of anticipation of Claims 1, 4-6, 10 and 17.

Nor does the disclosure of Strehlau render the subject matter of Claims 2, 3, 9 and (Original) 13 obvious. That disclosure suggests nothing at all about the replacement of the sulfur component trapping agent upon indication of degradation. The regeneration at high temperatures disclosed by Strehlau requires fuel consumption, and the only obvious thing is that such a method undesirably increases fuel cost.

By way of summary, the claimed apparatus of the present application has a NO_x purification catalyst, a sulfur component trapping agent disposed upstream of the NO_x purification catalyst, an oxidizing catalyst for oxidizing sulfur components in an exhaust gas from an internal combustion engine and an

indicator to indicate the degraded state of the sulfur component trapping agent. The sulfur component trapping agent traps oxidized sulfur components as sulfates having a melting point of decomposition temperature of at least 750°C and retains the sulfates under the operation conditions of the internal combustion engine. The sulfur component trapping agent is replaced upon the indication by the indicator. That is, the sulfur component trapping agent traps oxidized sulfur components (SO_3), which forms sulfates (MSO_4 ; M is alkali metal or alkaline earth metal) having a high melting point or high decomposition temperature (lines Table 1 on page 12), and it never releases the trapped sulfur components during the operation of the internal combustion engine.

The sulfur component agent may contain noble metals such as Pt, but an amount thereof should be as small as possible. If the amount of the noble metal exceeds 0.4% by weight, a considerable amount of the trapped sulfur components may be released during the operation of the engine. Preferably, the amount of noble metal in the sulfur component trapping should be zero (page 8, lines 15-17 and page 29, lines 8-12 of the Specification). Also, the sulfur component trapping agent is replaced when it reaches predetermined degradation or saturation.

Thereby, the present invention provides an exhaust gas purification apparatus providing both low emission of sulfur components and low fuel consumption.

The secondary art, even if it could be argued that the combination with Strehlau's teachings wouldn't have required hindsight, still would not have

yielded the present invention. As regards Claims 7 and 8, for example, such claims disclose a regenerable catalyst comprising copper oxide for entrapping Sox and is used in association with a catalyzed soot filter. Because the sulfur trapping catalyst in McCabe is regenerable, the sulfur component trapping agent is, on its face, quite different.

As to Claim 18, Twigg discloses only a combination of an upstream oxidation catalyst 22, a filter 24 and a replaceable sulfur absorber 26. The location of the NOx catalyst is not described. In the present invention, however, the order from the engine is the SOx oxidizing catalyst, sulfur component trapping agent and lastly the NOx catalyst.

Twigg says that Fig. 1 shows an exhaust gas treatment reactor, but does not show the relationship with NOx purification catalyst. Its description does not teach the relationship with the NOx purification catalyst. Instead, Twigg states that SOx, NOx, HC in the exhaust gas are oxidized by the oxidation catalyst 22. The oxidized NOx such as NO₃ combusts soot in the exhaust gas. This means that oxidized NOx (NO₃) may be reduced by combustion of soot into N₂, NO₂ and/or NO, the NO₂ and NO not being good for being absorbed or adsorbed by the NOx trapping component such as alkali metal or alkaline earth metal of the NOx purification catalyst. In the present invention, however, the NOx purification catalyst contains alkali metal and/or alkaline earth metal and a noble metal. Therefore, NOx that enters the NOx purification catalyst is oxidized on the catalyst and is effectively and securely absorbed or adsorbed in

the alkali metal or alkaline earth metal of the NO_x purification catalyst. The present invention's sulfur component trapping agent is substantially free from the noble metal so that oxidation of SO_x and NO_x does not occur in the sulfur component trapping agent. This reaction may cause the sulfates to be released from the trapping agent. Although Twigg generally teaches replacement upon notification, its NO_x purification catalyst is fundamentally different from the catalyst set forth in the apparatus claims of this application.

Finally, as to Claims 19 and 20, the Taga patent discloses a sulfur trapping agent, but one which is regenerated by elevating the temperature of the exhaust gas. Kubo may disclose an indication means, but the sulfur trapping agent is regenerated under running conditions of an internal combustion engine, unlike the present invention.

The cited art, alone or in hypothetical combination, does not set forth a *prima facie* case of anticipation or obviousness. Accordingly, early and favorable action is earnestly solicited.

If there are any questions regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and

please charge any deficiency in fees or credit any overpayments to Deposit

Account No. 05-1323 (Docket # 102147.58294US).

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Respectfully submitted,



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